Appendix B

State of California
Air Resources Board

Benefits of California's Zero-Emission Vehicle Standards on Community-Scale Emission Impacts

Staff Report

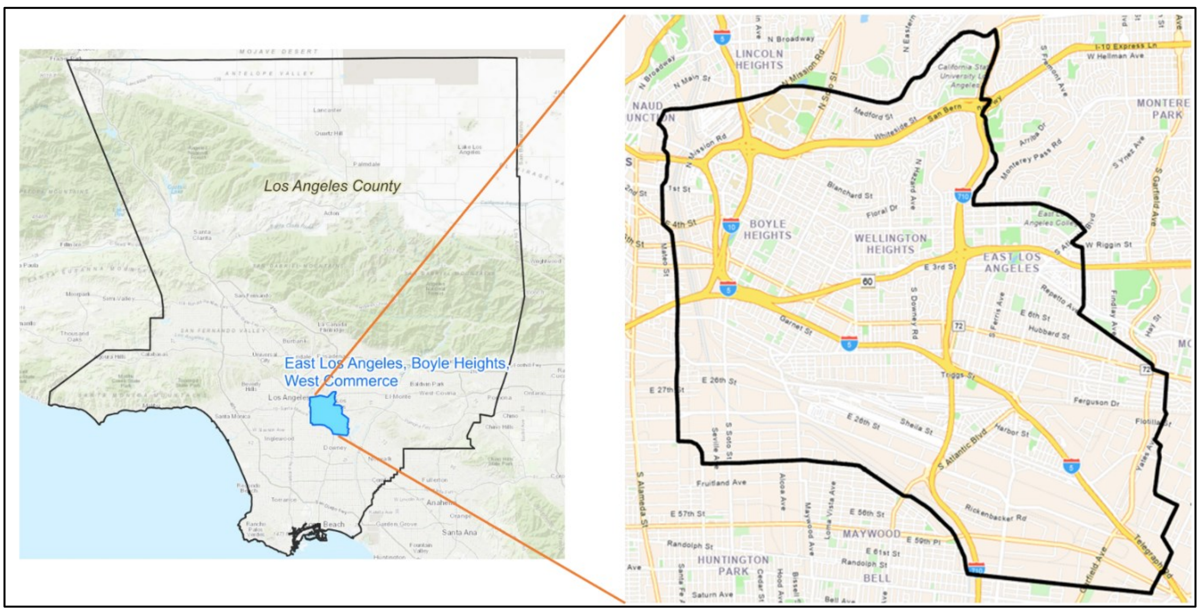
Date of Release: July 6, 2021

This report has been prepared by the staff of the California Air Resources Board and approved by the Executive Officer for publication. At this time, this report has not been approved by a vote of the Board itself, and, accordingly, the views expressed herein should not be assumed to necessarily reflect those of the Board. In addition, the use of trade names or commercial products herein does not constitute endorsement or recommendation.

Summary

The benefits of California's Zero-Emission Vehicle (ZEV) standards are especially critical from a community perspective in disadvantaged communities along heavily traveled roads. In these communities, the pollution and public health impacts from on-road vehicle emissions are especially significant and greater than in other communities. One such community is the East Los Angeles, Boyle Heights, West Commerce (East LA/Boyle Heights/West Commerce) community. This community has more than 30 miles of freeways within its approximately 26 square mile emissions study boundary area (Figure 1), making on-road emissions a significant contributor to the community's air pollution exposure, and its population shows a greater degree of health impacts from air pollution than other communities. The following analysis describes the air quality benefits of California's zero-emission vehicle standards in this community.

Figure 1. East LA/Boyle Heights/West Commerce Community Emissions Study Boundary



Background - About the Community

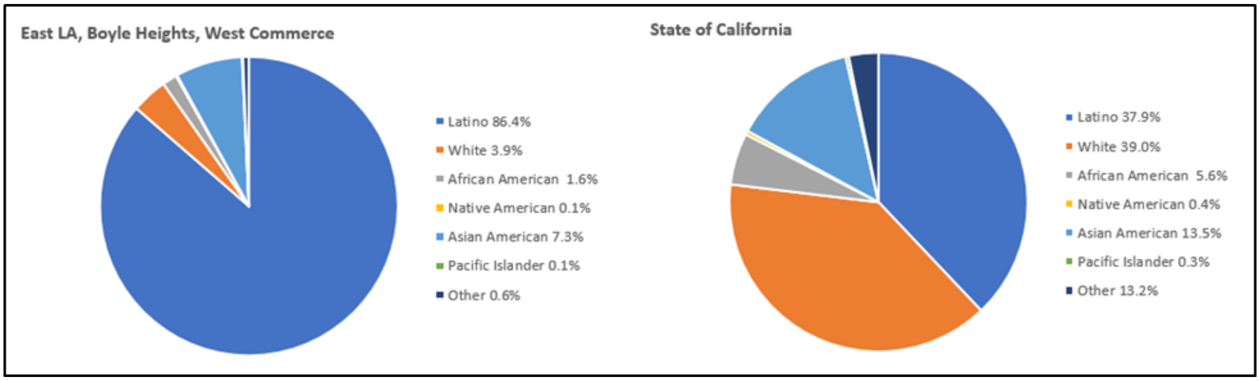
Based on the 2018 American Community Survey (ACS) data from the Census Bureau[1], more than 310,600 people live within the East LA/Boyle Heights/West Commerce community emission study boundary. Major freeways bisecting the community include Highways 101 and 60, and Interstates 5, 10, and 710, resulting in four freeway

[1] U.S. Census Bureau, 2014-2018 American Community Survey 5-year Estimates. *https://data.census.gov/cedsci/*

junctions and increased pollution exposures for the populations living and working in this community as compared to Los Angeles County as a whole.

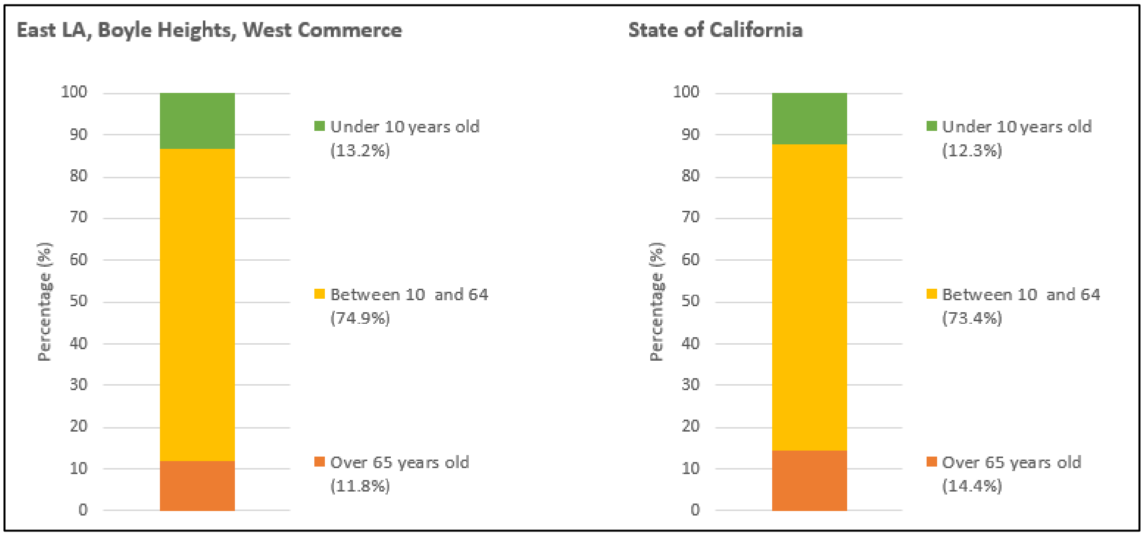
Approximately 86% of the population in this community is Latino (Figure 2), nearly 13% are children under the age of 10 years, and 12% of the population is elderly (over the age of 65 years) (Figure 3). These population characteristics are important indicators of disparities in existing pollution burden, exposure to air pollution, and health vulnerabilities - especially for children and the elderly.[2]

Figure 2. Comparison of Population by Race/Ethnicity in East LA/Boyle Heights/West Commerce Community and the State of California using the Latest American Community Survey 5-year Estimates (2014-2018)



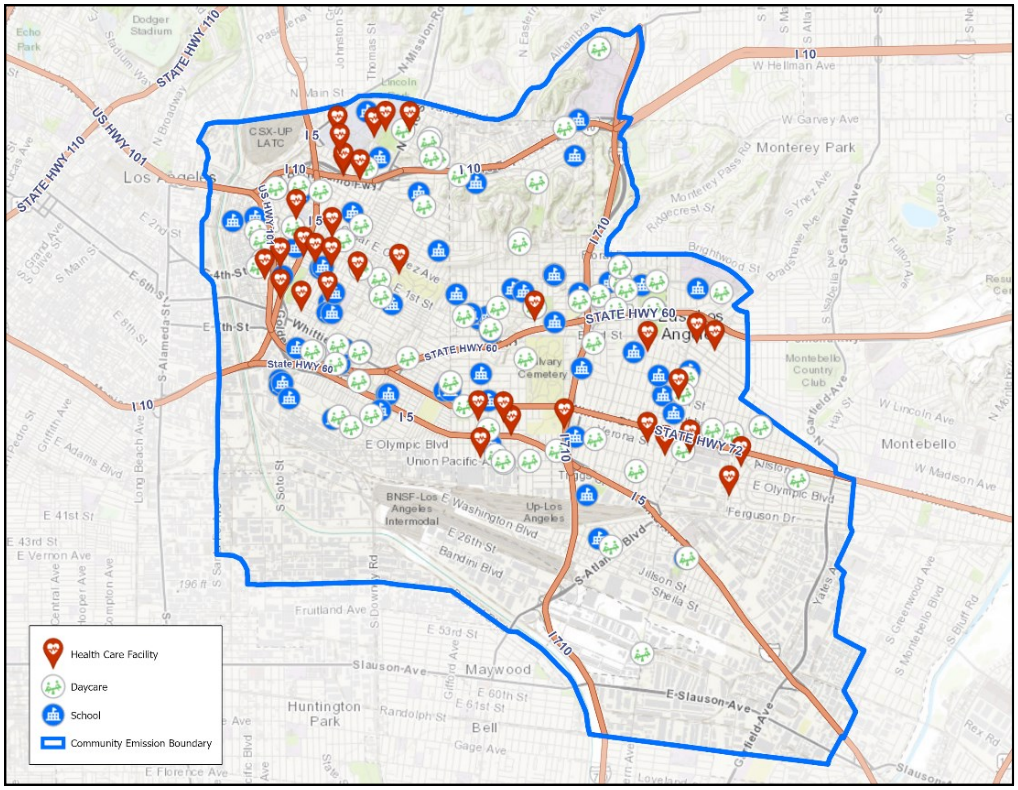
[2] The metrics presented here are the same as the data presented in the 2019 Community Emissions Reduction Plan for East Los Angeles, Boyle Heights, West Commerce, but have been updated to include the latest Census ACS 5-year estimates (2014-2018) for the emission study boundary. South Coast Air Quality Management District, Assembly Bill (AB) 617 Community Air Initiatives, Community Emissions Reduction Plan for East Los Angeles, Boyle Heights, West Commerce, September 2019, *http://www.aqmd.gov/docs/default-source/ab-617-ab-134/steering-committees/east-la/cerp/carb-submittal/final-cerp.pdf?sfvrsn=8*

Figure 3. Comparison of Age profile in East LA/Boyle Heights/West Commerce Community and the State of California using the Latest American Community Survey 5-year Estimates (2014-2018)



Certain groups of the general population are more vulnerable to air pollution by virtue of their age and health, including children, elderly, pregnant women, and health compromised individuals. Places where these sensitive populations gather, called sensitive receptor locations, can include schools, day-care providers, hospitals, nursing homes, and senior care facilities. There are numerous sensitive receptor locations in the East LA/Boyle Heights/West Commerce community, including 80 schools, 79 day-care providers, and 36 health care facilities including hospitals, nursing homes and dialysis clinics (Figure 4).

Figure 4. Sensitive Receptors in East LA/Boyle Heights/West Commerce Community[3]



Most of the census tracts in this community are considered disadvantaged under California law.[4] Approximately 90% of the census tracts in this community are in the top 25% (75-100th percentile) of the Draft CalEnviroScreen 4.0[5] (CES) scores within the State. The California Office of Environmental Health Hazard Assessment's (OEHHA) CES is a screening method that can be used to help identify California communities

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[3] Public and private schools data obtained from the Dept. of Education for the 2018 school year. Hospitals and Other Licensed Healthcare Facilities: The data are from both Office of Statewide Health Planning and Development (OSHPD), and California Department of Public Health (CDPH), *https://data.chhs.ca.gov/dataset/healthcare-facility-locations*
Daycares: Data are from California Department of Public Health (CDPH) *https://data.chhs.ca.gov/dataset/community-care-licensing-child-care-center-locations*
Nursing Homes: Data from Homeland Infrastructure Foundation-Level Data (HIFLD) database , Oak Ridge National Laboratory (ORNL), National Geospatial-Intelligence Agency (NGA) Homeland Security Infrastructure Program (HSIP) Team. *https://gii.dhs.gov/HIFLD.* Data was downloaded via ArcGIS Online Living Atlas as of June 4, 2021.
Dialysis clinics/Home Health Care: Data were compiled by Federal User Community, National Maps for USA, National Apps for USA, and A-16, and downloaded via ArcGIS Online Living Atlas June 4, 2021.
[4] Disadvantaged community designations per Senate Bill 535 (De León, Chapter 830, Statutes of 2012).
[5] The Office of Environmental Health Hazard Assessment (OEHHA) released a draft version of the California Communities Environmental Health Screening Tool: CalEnviroScreen 4.0 in February 2021. *https://oehha.ca.gov/calenviroscreen/report/draft-calenviroscreen-40*

that are disproportionately burdened by multiple sources of pollution. The maximum overall CES score for any census tract in the community is in the 99th percentile, which means that people living in that census tract are in the top 1% of the most impacted census tracts in the State. Tables 1.1 and 1.2 present the maximum percentile for exposure (e.g., ozone, PM2.5, diesel PM, traffic impacts), health status (asthma, cardiovascular disease, low birth weight), and socio-economic (education, linguistic isolation, poverty, unemployment, and housing burden) indicators for the census tracts in this community. It also presents the number of census tracts in the community that are in the top 25% (75-100th percentile) of impacted tracts in the State. Figure 5 compares the average scores for the above indicators in the community against statewide averages - the community scores for these key indicators are generally higher compared to the statewide averages.

The metrics discussed above also explain the disparate effects of air pollution faced by other communities across the State. Many California communities experience significantly higher levels of both regional and near-source air pollution; and the demographic and socio-economic characteristics of these communities exacerbate their susceptibility and vulnerability to the adverse effects of air pollution. A 2019 CARB research study revealed on-road vehicles and industrial activity to be the top two sources of exposure in California, each contributing to 24 percent of the total PM2.5 exposure, and disproportionately impacting non-white and low-income populations.[6]

Figure 6 presents the average scores for PM2.5 concentrations and diesel PM emissions relative to statewide averages for a few communities across the State; vehicle emissions contribute predominantly to the particulate matter and diesel PM impacts in these communities. The chart also includes asthma related emergency room visits and linguistic isolation (i.e., limited English speaking) as proxies for demographic and socio-economic disadvantages faced by these communities.

Existing scientific literature conclusively links air pollution to adverse health outcomes, including pre-mature mortality, and the disproportionate pollution and health burden on poor and socially disadvantaged communities. OEHHA's draft CES 4.0 report provides an exhaustive review of existing literature connecting each of the indicators used in the CES method to pollution burden and population sensitivities.[7]

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[6] Apte J. et al (2019). A Method to Prioritize Sources for Reducing High PM2.5 Exposures in Environmental Justice Communities in California. CARB Research Contract Number 17RD006. *https://ww2.arb.ca.gov/sites/default/files/classic//research/apr/past/17rd006.pdf*

[7] OEHHA Draft CES 4.0 Report (Feb 2021), pages 26-191, "Individual Indicators: Description and Analysis". *https://oehha.ca.gov/media/downloads/calenviroscreen/document/calenviroscreen40reportd12021.pdf*

Table 1.1. DRAFT CalEnviroScreen (CES) 4.0 Overall Score in the East LA/Boyle Heights/West Commerce Community

CES 4.0 Overall Score	Number of Census Tracts with Highest CES Scores (Top 25%, 75-100th Percentile)	Percent of Census Tracts with Highest CES Scores (Top 25%, 75-100th Percentile)[8]	Maximum Percentile in Community
CES Score	67	89%	99.9

Table 1.2. DRAFT CalEnviroScreen (CES) 4.0 Scores for Key Exposure, Health, and Socio-Economic Indicators in the East LA/Boyle Heights/West Commerce Community

CES 4.0 Indicators	Number of Census Tracts with Highest CES Scores (Top 25%, 75-100th Percentile)	Percent of Census Tracts with Highest CES Scores (Top 25%, 75-100th Percentile)[9]	Maximum Percentile in Community	Indicator Description
Ozone	0	0%	61.9	Amount of daily maximum 8-hour Ozone concentrations
PM2.5	76	100%	95.0	Annual mean PM 2.5 concentrations
Diesel PM	65	86%	99.3	Diesel PM emissions from on-road and non-road sources
Traffic Impacts	47	62%	98.8	In vehicle-kilometers per hour per road length, within 150 meters of census tract boundary
Asthma	29	38%	94.9	Age-adjusted rate of emergency department visits for asthma
Low Birth Weight	23	31%	99.7	Percent low birth weight
Cardiovascular Disease	26	34%	90.2	Age-adjusted rate of emergency department visits for heart attacks per 10,000
Education	69	92%	99.5	Percent of population over 25 with less than a high school education
Linguistic Isolation	64	85%	98.3	Percent limited English speaking households
Poverty	53	71%	99.0	Percent of population living below two times the federal poverty level
Unemployment	32	44%	97.7	Percent of population over the age of 16 that is unemployed and eligible for the labor force
Housing Burden	43	58%	96.0	Percent housing burdened low-income households

[8] The percentages for the overall CES 4.0 score represent the number of census tracts in this community that are considered "disadvantaged" per SB 535 (75th percentile or top 25% of all census tracts in the State).
[9] The percentages for the individual CES 4.0 metrics present the number of census tracts in the community that are in the top 25% of census tracts for a given indicator.

Figure 5. DRAFT CalEnviroScreen (CES) 4.0 Scores for Key Indicators in the East LA/Boyle Heights/West Commerce Community Relative to Statewide Averages

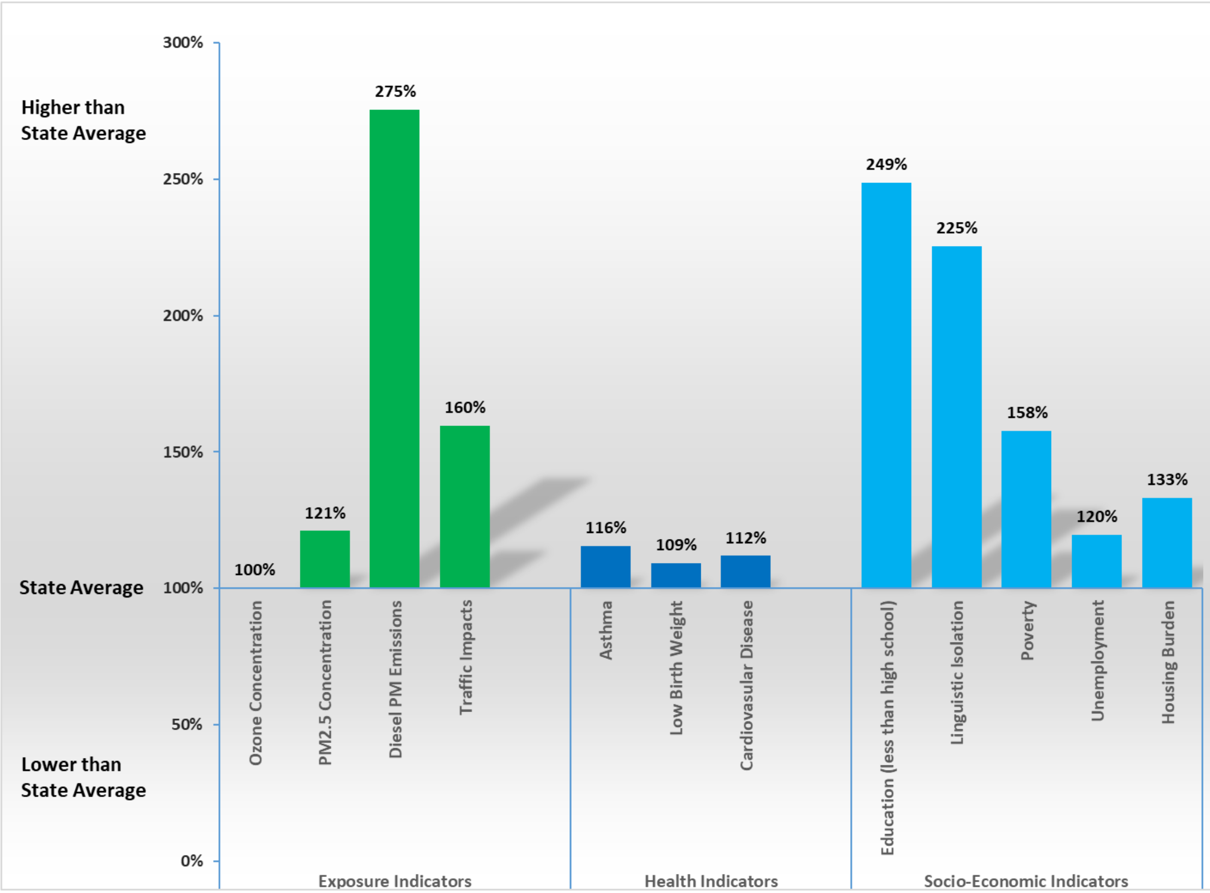
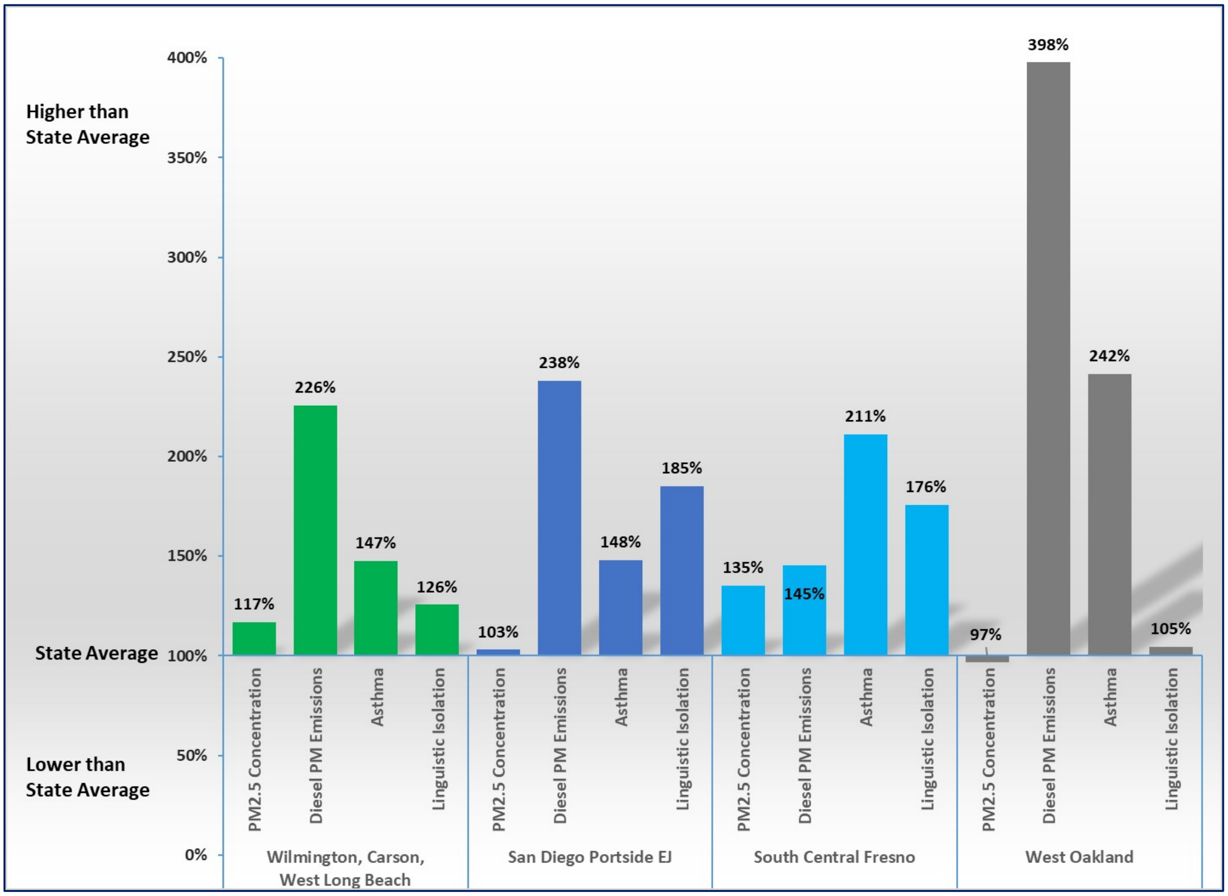


Figure 6. DRAFT CalEnviroScreen 4.0 Scores for PM2.5 Concentrations, Diesel PM Emissions, and Socio-economic Indicators in California Communities



Analysis - On-Road Mobile Emissions in the Community

A variety of sources contribute to the emissions of criteria pollutants in the East LA/Boyle Heights/West Commerce community, with on-road mobile sources among one of the largest emitters of criteria pollutants like nitrogen oxides (NOx), total organic gases (TOG), and particulate matter (PM) emissions.

Criteria pollutant emissions from on-road vehicles in Los Angeles County make up roughly 45% of all NOx emissions, 22% of all volatile organic carbon (VOC) emissions (which are a subset of TOG emissions), and 18% of all PM2.5 emissions.[10] Due to the significant number of freeways that traverse the community, the East LA/Boyle Heights/West Commerce community has a higher percentage of NOx, VOC, and PM2.5 emissions from on-road vehicles as compared to Los Angeles County. On-road

[10] California Air Resources Board Preliminary SIP Emission Inventory Data for Los Angeles County, California Emission Projection Analysis Model (CEPAM) v1.02. Data downloaded in June 2021.

emissions in the East LA/Boyle Heights/West Commerce community make up 58% of all NOx emissions, 29% of all VOC emissions, and 23% of all PM2.5 emissions.[11]

Passenger light-and medium-duty vehicles emit most of the on-road TOG and PM2.5 emissions. Passenger light-and medium duty vehicles also emit nearly half of all NOx emissions from on-road vehicles. Figure 7 shows the relative contribution of passenger light-and medium-duty vehicle emissions as compared to all other vehicles in the East LA/Boyle Heights/West Commerce community. Passenger cars are the main source of TOG emissions because of the large number of vehicles and miles travelled by these types of vehicles in the community. PM2.5 emissions from on-road sources are from fuel combustion as well as from tire and brake wear. Light- and medium-duty vehicles are the main contributors to the total emissions of PM2.5, as these vehicles travel the most miles in the community.

Figure 8 shows the toxicity weighted emissions for the top 10 toxic air contaminants (TACs) with a cancer risk health value from passenger light- and medium-duty vehicles in the community.[12] Benzene and 1,3-butadiene contribute the most to the cancer risk weighted emissions from these vehicles in the community. Reducing criteria pollutant and TAC emissions from passenger light-and medium-duty vehicles through the increased adoption of ZEVs could have a significant impact in reducing the air pollution burden on the community and substantial impact on overall health and well-being of people living and working there.

[11] Community Emissions Reduction Plan for East Los Angeles, Boyle Heights, West Commerce, September 2019 *http://www.aqmd.gov/docs/default-source/ab-617-ab-134/steering-committees/east-la/cerp/carb-submittal/final-cerp.pdf?sfvrsn=8*

[12] One way to compare different toxic pollutants is to look at Toxicity Weighted Emissions (TWE). TWE are adjusted emissions for TACs that have OEHHA approved health values. They are calculated by multiplying the mass emissions of each TAC by the corresponding health values as determined by OEHHA, molecular weight adjustment factors accounting for the molecular weight fraction of a compound associated with the specific health effects, maximum hours of emissions, and normalization factors (these are factors that allow the conversion of different toxic pollutant emissions into a standard to help compare pollutants to one another). TWEs are not risks, but the weighted emissions are useful to compare the relative toxicity of TACs.

Figure 7. On-road sources of 2017 NOx, TOG, and PM2.5 Emissions in East LA/Boyle Heights/West Commerce (tons per year)

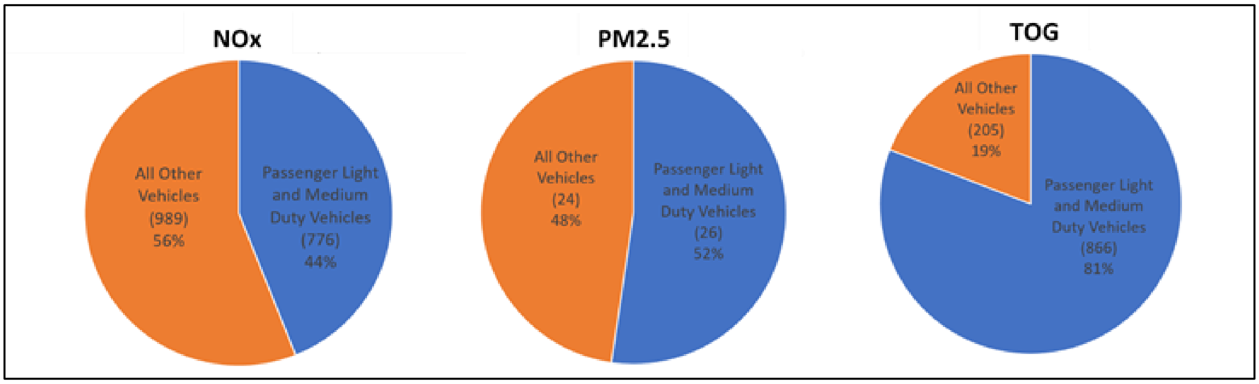
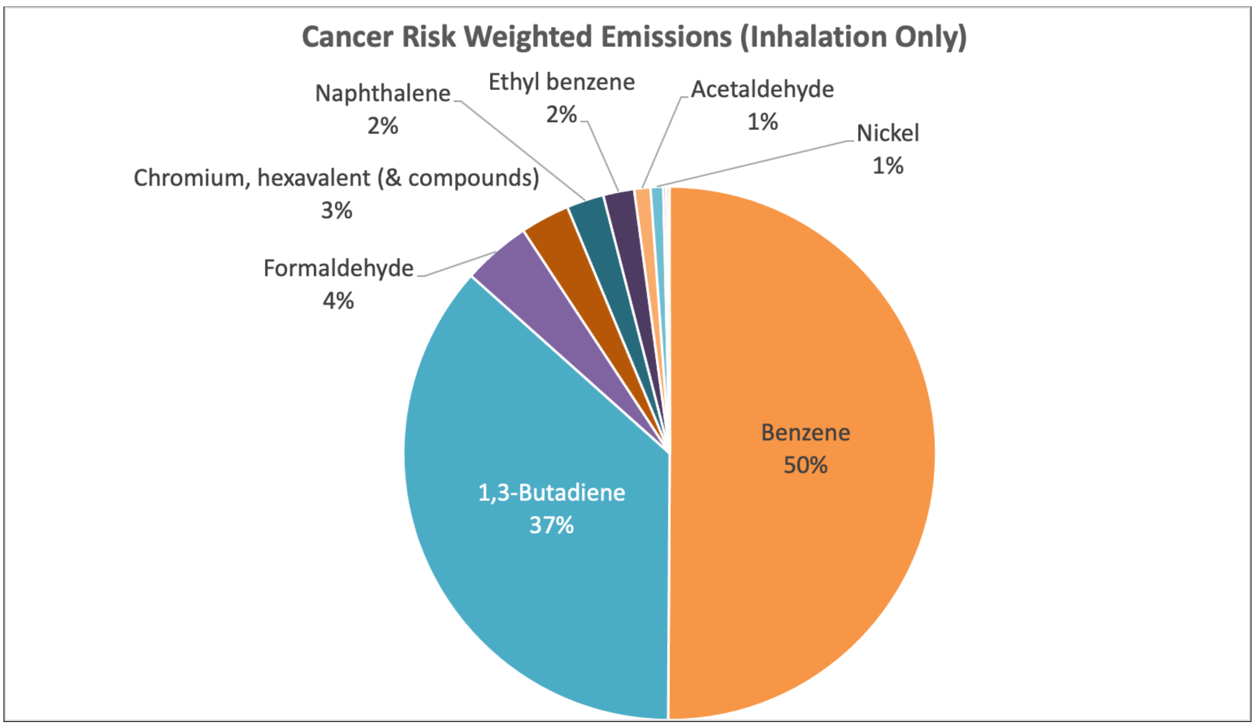


Figure 8. 2017 Cancer Toxicity Weighted Emissions from Passenger Light- and Medium-Duty Vehicles in East LA/Boyle Heights/West Commerce (pounds per year)



Impact of California ZEV Standards on Emissions in the Community

California has adopted requirements for zero-emission passenger vehicles for model years 2017-2025 as part of its Advanced Clean Cars (ACC) program. To evaluate the impact of California's ZEV program at the community level, the most current version of CARB's on-road emission modeling tool, EMFAC2021, was used in conjunction with latest activity data from the Southern California Association of Governments for the

East LA/Boyle Heights/West Commerce community. EMFAC2021 is based on the best available vehicle emissions and activity data, and reflects the most recent model development, emission standards, and adopted regulations in California.[13] To be consistent with the accompanying criteria pollutant and GHG analyses, CARB calculated the community-scale emission impacts from California's ZEV program for calendar years 2021, 2023, 2030, 2031, 2035, and 2037. The results presented below are also summarized in Table 2.[14]

If the 2017 model year and newer pure zero-emission electric vehicles (i.e., battery or fuel cell electric vehicles) and plug-in hybrid electric vehicles (PHEV) sold due to California's program were instead equivalent gasoline vehicles, these vehicles would emit, in calendar year 2021, an additional:

- 2.9 tons of NOx exhaust emissions,
- 3.2 tons of TOG exhaust and evaporative emissions,
- 0.2 tons of PM2.5 exhaust emissions, and
- 0.2 tons of PM2.5 brake and tire wear emissions.

By 2023, without California's ZEV program, there would be more gasoline vehicles of the equivalent model years and an additional:

- 4.5 tons of NOx exhaust emissions,
- 4.6 tons of TOG exhaust and evaporative emissions,
- 0.2 tons of PM2.5 exhaust emissions, and
- 0.2 tons of PM2.5 brake and tire wear emissions.

In 2030, the increase would be:

- 9.4 tons of NOx exhaust emissions,
- 8.2 tons of TOG exhaust and evaporative emissions,
- 0.2 tons of PM2.5 exhaust emissions, and
- 0.4 tons of PM2.5 brake and tire wear emissions.

By 2031, the annual increase would be:

- 10 tons of NOx exhaust emissions,
- 8.7 tons of TOG exhaust and evaporative emissions,

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[13] EMFAC is approved by U.S. EPA for planning required to meet the National Ambient Air Quality Standards. See 40 C.F.R. §§ 93.110, 93.111; 80 Fed.Reg. 77,337 (Dec. 14, 2014) [EMFAC2014 approval]; 84 Fed.Reg. 41,717 (Aug. 15, 2019) [EMFAC2017 approval]. EMFAC2021 is pending submittal to and approval by U.S. EPA.

[14] Criteria pollutant emission impacts from California's ZEV program are calculated by applying statewide emission increase factors to the East LA/Boyle Heights/West Commerce community on-road emissions in tons per year. The increase factors were estimated by comparing two emission scenarios using EMFAC2021 – a baseline scenario, where the light-duty fleet includes California's ZEV standards and is comprised of ICEs, ZEVs, and PHEVs, and another scenario where all the ZEVs and PHEVs are replaced with gasoline ICEs for model years 2017 and newer.

- 0.2 tons of PM2.5 exhaust emissions, and
- 0.5 tons of PM2.5 brake and tire wear emissions.

In 2035, the increase would be:

- 12.3 tons of NOx exhaust emissions,
- 11.4 tons of TOG exhaust and evaporative emissions,
- 0.2 tons of PM2.5 exhaust emissions, and
- 0.6 tons of PM2.5 brake and tire wear emissions.

In 2037, without California's ZEV program the increase would be:

- 13.2 tons of NOx exhaust emissions,
- 12.8 tons of TOG exhaust and evaporative emissions,
- 0.2 tons of PM2.5 exhaust emissions, and
- 0.6 tons of PM2.5 brake and tire wear emissions.

Table 2.1, 2.2, and 2.3 show the estimated baseline emissions in the community from gasoline internal combustion engine (ICE) vehicles, ZEVs, and PHEVs. It then shows the emission increases for NOx, TOG, and PM2.5 in future years if the ZEVs and PHEVs required by California's program are instead model year 2017 and newer vehicles with conventional gasoline engines.

Table 2.1. Baseline Community Emissions (in tons per year) from ICEs + ZEVs + PHEVs, All Model Years

Calendar Year	NOx Exhaust (tons/year)	TOG Exhaust (tons/year)	TOG Evaporative (tons/year)	PM2.5 Exhaust (tons/year)	PM2.5 Brake Wear (tons/year)	PM2.5 Tire Wear (tons/year)
2021	480.2	309.7	300.7	6.6	11.1	6.8
2023	379.2	250.4	275.0	5.8	11.0	6.8
2030	212.6	145.0	208.7	3.9	10.5	6.6
2031	200.6	136.5	201.3	3.6	10.5	6.5
2035	171.8	113.5	187.4	2.9	10.6	6.6
2037	162.5	105.2	183.4	2.6	10.6	6.6

Table 2.2. Emission Increases (in tons per year) from Replacing Model Years 2017+ ZEVs and PHEVs with Equivalent Gasoline Vehicles in the Community

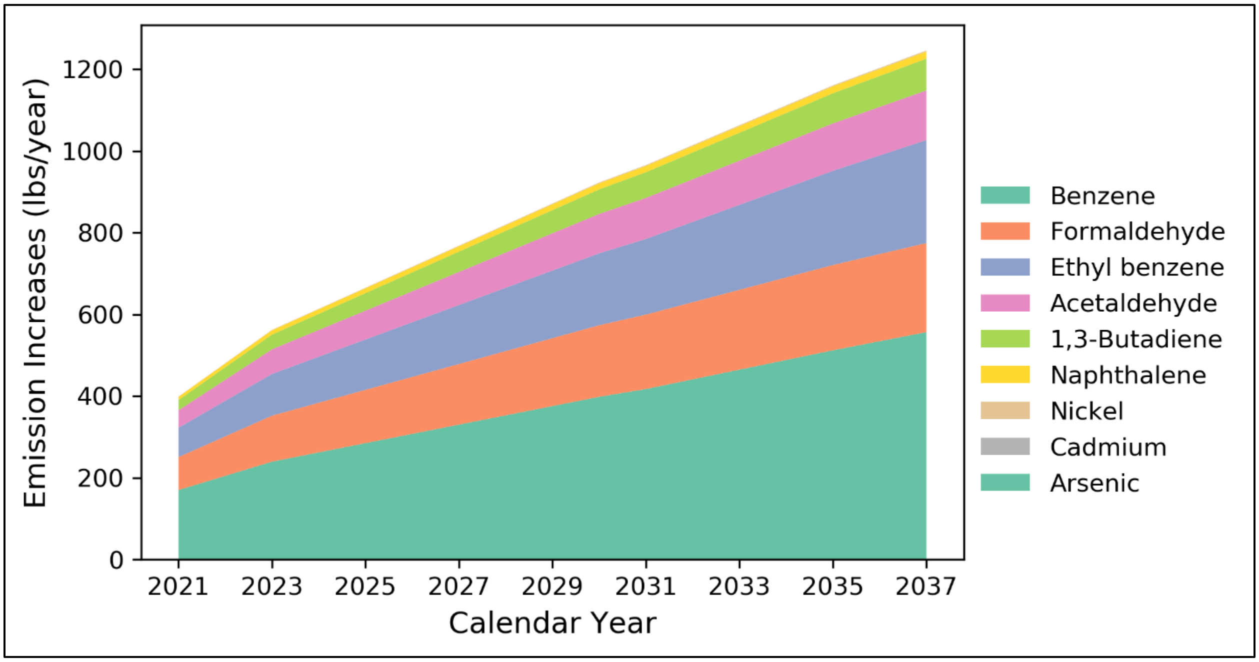
Calendar Year	NOx Exhaust (tons/year)	TOG Exhaust (tons/year)	TOG Evaporative (tons/year)	PM2.5 Exhaust (tons/year)	PM2.5 Brake Wear (tons/year)	PM2.5 Tire Wear (tons/year)
2021	2.9	2.3	0.9	0.2	0.2	0.02
2023	4.5	3.2	1.3	0.2	0.2	0.01
2030	9.4	5.1	3.1	0.2	0.4	0.01
2031	10.0	5.4	3.4	0.2	0.5	0.02
2035	12.3	6.2	5.2	0.2	0.6	0.02
2037	13.2	6.5	6.3	0.2	0.6	0.03

Table 2.3. Emission Increases (in percentages) from Replacing Model Years 2017+ ZEVs and PHEVs with Equivalent Gasoline Vehicles in the Community

Calendar Year	NOx Exhaust (Percent)	TOG Exhaust (Percent)	TOG Evaporative (Percent)	PM2.5 Exhaust (Percent)	PM2.5 Brake Wear (Percent)	PM2.5 Tire Wear (Percent)
2021	0.6%	0.7%	0.3%	2.4%	1.4%	0.2%
2023	1.2%	1.3%	0.5%	3.3%	2.1%	0.2%
2030	4.4%	3.5%	1.5%	6.1%	4.2%	0.2%
2031	5.0%	3.9%	1.7%	6.4%	4.5%	0.2%
2035	7.2%	5.4%	2.8%	8.0%	5.4%	0.4%
2037	8.1%	6.2%	3.4%	8.7%	5.7%	0.4%

Along with criteria pollutant emission increases, the absence of a ZEV program in California will also increase emissions of toxic air contaminants. While the increased criteria pollutant emissions add to the burden of achieving healthful air in a timely manner for many communities, the related increase in toxics could be even more consequential for the community living along major freeways and heavily traveled roads. Unlike criteria pollutants, toxics (especially cancer causing) have no safe exposure thresholds, and any increase in these emissions adversely impacts the health of individuals and communities. Figure 9 shows the emission increase trend from 2021 through 2037 for the top 10 toxics with an OEHHA-approved cancer risk health value.

Figure 9. Emission Increases (lbs/year) for the Top 10 Toxics from Passenger Light- and Medium-Duty Vehicles in East LA/Boyle Heights/West Commerce in the Absence of California's ZEV Program



Methodology

To determine emission impacts from California's ZEV requirement under the Advanced Clean Cars program at the community level, the following methodologies and assumptions are used.

1. On-road community inventories are developed by multiplying vehicle activity in terms of vehicle miles traveled (VMT) on each road segment by vehicle emissions factors according to road segment vehicle distribution. Vehicle distribution and VMT data from the Southern California Association of Governments (SCAG) 2020-2045 Regional Transportation Plan/Sustainable Communities Strategy (RTP 2020) was used for this analysis.[15] Emission factors by vehicle type from EMFAC2021[16] were used for this analysis. EMFAC2021 is used to generate the default population and emission outputs because it is based on the best available emissions and activity data and reflects the

[15] Southern California Association of Governments, 2020–2045 Regional Transportation Plan/Sustainable Communities Strategy. Adopted September 2020. *https://scag.ca.gov/read-plan-adopted-final-plan*
[16] Emission factors by vehicle type are calculated using on-road emissions for Los Angeles County downloaded from EMFAC2021 on May 28, 2021.

most recent model development, emission standards, and adopted regulations in California.[17]

2. Criteria pollutant emission impacts from California's ZEV program are calculated by applying statewide emission increase factors to the East LA/Boyle Heights/West Commerce community on-road emissions in tons per year. The increase factors were estimated by comparing two emission scenarios using EMFAC2021 – a baseline scenario, where the light duty fleet includes the California's ZEV standards and is comprised of ICEs, ZEVs, and PHEVs, and another scenario where all the ZEVs and PHEVs are replaced with gasoline ICEs for model years 2017 and newer. The increase factors for each pollutant are calculated as:

$$\text{Emission Increase Factors}_{\text{Pollutant}}\ (\%) = \left(\frac{\text{All Gasoline Emissions} - \text{Baseline Emissions}}{\text{Baseline Emissions}}\right)_{\text{Pollutant}} \times 100$$

3. CARB staff assumed that the replaced vehicles would have the same emission rate in grams/vehicle/day per gasoline vehicle per model year, which is calculated from the total estimated emissions of gasoline vehicles in tons/day for each pollutant, divided by the gasoline vehicle population for each 2017 and newer model year under the chosen calendar year using the default EMFAC2021 output.[18]
4. Toxics emission impacts from California's ZEV program are calculated by applying statewide PM and TOG emission increase factors (same as above) to the East LA/Boyle Heights/West Commerce community on-road heavy metal and organic toxic air contaminant emissions (in pounds per year) respectively.
5. The on-road heavy metal and organic toxics emissions, mentioned in the previous step, are calculated using chemical speciation profiles for PM and TOG species by source category, process, and material or fuel type. The chemical speciation profiles are developed, maintained, and updated by CARB[19], and essentially break down PM and TOG emissions into their individual constituents, including toxics, for each source category, process and material or fuel type. Then all the species which are listed in Appendix A-I of AB 2588 Air Toxics "Hot Spots" Emission Inventory Criteria and Guidelines Regulation[20] are filtered out as toxics. The TOG-based toxics (e.g., formaldehyde, benzene, xylenes, naphthalene, 1,3-butadiene) are estimated using TOG speciation profiles, and PM based toxics (heavy metals such as lead, chromium, nickel, and arsenic) are estimated using PM speciation profiles. There are some toxic air contaminant species that are not presently included in the speciation profiles, e.g., hexavalent chromium, which is a carcinogen. Therefore, CARB augments the

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[17] See CARB, *EMFAC2021 Volume III Technical Document, April 2021.* *https://ww2.arb.ca.gov/sites/default/files/2021-04/emfac2021_technical_documentation_april2021.pdf*
[18] Note, this is consistent with the approach in the accompanying analysis of criteria emission benefits of California's zero-emission vehicle program in California, considering the state's vehicle sales and other state-specific data.
[19] Speciation Profiles Used in CARB Modeling. *https://ww2.arb.ca.gov/speciation-profiles-used-carb-modeling*
[20] AB 2588 Air Toxics "Hot Spots" Emission Inventory Criteria and Guidelines Regulation. *https://ww2.arb.ca.gov/our-work/programs/ab-2588-air-toxics-hot-spots/hot-spots-inventory-guidelines*

hexavalent chromium to include their emissions in the community inventory. Hexavalent chromium emissions are estimated as 5% of the total speciated chromium emissions for liquid fuel combustion sources.

6. Toxicity Weighted Emissions (TWE) are calculated for all TACs using health values[21] approved by OEHHA. It is important to note that TWEs are not risks, but weighted emissions useful to compare relative toxicity of TACs. TWEs are calculated by multiplying mass emissions of each TAC by the corresponding health values (e.g., cancer unit risk factor, non-cancer chronic, and acute reference exposure levels) as determined by OEHHA, molecular weight adjustment factors accounting for the molecular weight fraction of a compound associated with the specific health effects, maximum hours of emissions, and normalization factors.
7. Calendar Years 2021, 2023, 2030, 2031, 2035 and 2037 are selected to demonstrate the emission impacts from the absence of California's ZEV program. Emission are evaluated for different criteria pollutants and TACs. Examples of criteria pollutants include NOx total exhaust emissions (NOx Exhaust), TOG total exhaust (TOG Exhaust) and evaporative (TOG Evaporative) emissions and PM2.5 total exhaust (PM2.5 Exhaust), brake wear (PM2.5 Brake Wear), and tire wear (PM2.5 Tire Wear) emissions. For toxic air contaminants, emission impacts are evaluated for Benzene, 1,3-Butadiene, Formaldehyde, Hexavalent Chromium, Naphthalene, Ethyl benzene, Acetaldehyde, Nickel, Cadmium, and Arsenic.

[21] OEHHA Approved Health Values. *https://ww2.arb.ca.gov/sites/default/files/classic/toxics/healthval/contable.pdf*